

## DROSOPHILA MELANURA, A NEW SPECIES OF THE MELANICA GROUP

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During most of the summer of 1941 the author collected *Drosophila* and related forms on the River Campus of the University of Rochester at Rochester, New York. One of the commonest types to be found in the fermented banana traps used in the collections was a form identified as *Drosophila melanica* Sturtevant (1916). From June 5 through August 25 there were gotten 1263 individuals of this species, 538 of which were females, 725 males. In a recent paper Patterson (1942) has indicated that *D. melanica* should be divided into two subspecies, *melanica* and *paramelanica*, differing in distribution, *melanica* having been found in the southeastern United States and in Mexico, *paramelanica* occurring in the northeastern part of this country. It is probable, on the basis of locality, that the *D. melanica* individuals collected at Rochester belonged to the subspecies *paramelanica*. Towards the end of the collecting period, from August 19 through August 25, there occurred in the traps some male *Drosophilas* that seemed to differ from the *D. melanica* males only in the unusually dark pigmentation of their genital region. Altogether there were 10 such males collected. Since it was suspected that these males represented a new form, a number of apparently *D. melanica* females collected at the time were isolated individually into culture bottles in the hope that some of them would have offspring, males of which would be of this new type. Unfortunately, none of the females so isolated bred. Since it seemed unlikely that the females would have any progeny if left to themselves, an attempt was made to mate them to some of the *melanica*-like males. Culture bottles that had contained one of the females with two such males yielded some offspring. The male progeny were all of the new type in that their genital

\* This study was begun while the author was holding a teaching assistantship at the University of Rochester, Rochester, New York.

region was darkly pigmented. These offspring proved to be fertile, and through allowing them to mate among themselves a strain was derived. Males of succeeding generations have all persisted in differing from *D. melanica* males in the dark pigmentation of the genital region. On the basis of this constant character of difference, as well as because of others noted below, the *melanica*-like form collected at Rochester is here designated a separate species, *Drosophila melanura*. A description of the new species is given next, with notes on comparison of the new form with *D. melanica* following just afterwards.

### Description of the Species

#### *Drosophila melanura*, sp. nov.

##### EXTERNAL CHARACTERS OF IMAGINES.

♂ Arista with about 9 branches. Antennæ brownish, pollinose. Front blackish. Middle orbital length about  $\frac{1}{3}$  that of posterior one. Second oral length about  $\frac{1}{3}$  that of first. Carina broad below, sulcate. Face brownish. Cheeks pale brownish, about  $\frac{1}{3}$  greatest diameter of eye at their greatest width. Eyes red, with black pile.

Acrostichal hairs in irregular rows; about six rows at the anterior dorso-central bristles. Anterior scutellars convergent. Mesonotum dull brown, with four slightly paler longitudinal stripes, two extending forward from just inside anterior dorsocentral bristles, two lying just outside the lateral pairs of dorsocentral bristles. Pleuræ brownish. Sterno-index about 0.9. Legs pale brownish. Two apical bristles on first tibiæ, one on second; pre-apicals on all three.

Broad, brown bands on abdominal segments 2 through 6, with posteriorly narrowing median interruptions, with but little interruption near the lateral margins of the tergites. Genital region (genital arch, anal plates, claspers, penis apparatus) dark brown.

Wings clear, veins brown. Costal index about 2.9; 4th vein index about 1.4; 5x index about 0.9; 4c index about 0.6. Two bristles at apex of first costal section. Third costal section with bristles on its basal  $\frac{1}{3}$ .

Body length about 3.3 mm. (alive); wings 2.8 mm.

♀ Broad, brown bands on abdominal segments 2 through 6, with posteriorly narrowing median interruptions, often with wide lateral interruptions on the 6th segment.

Body length about 3.5 mm. (alive); wings 3.0 mm.

##### INTERNAL CHARACTERS OF IMAGINES.

Testis with about 3 inner coils (probably the seminal vesicle) and 3 outer ones, the coiled portion tending to be orange. Ejaculatory sac with 4 long diverticula, 2 anterior and 2 posterior.

Spermatheca chitinized. Ventral receptacle with about 30 coils.

## Additional notes.

EGG.—With 2 filaments, each about  $\frac{2}{3}$  the length of the egg.

PUPARIUM.—Amber. About 9 branches in each anterior spiracle. Horn index (length of puparium/length of anterior spiracle horn) about 12.

CHROMOSOMES.—Female metaphase plate contains: one pair of large V's, two pairs of rods, one pair of medium V's, and one pair of small V's. Male metaphase plate has a J in place of one of the large V's.

KEY POSITION.—The following is to be taken as an expansion of the first line of couplet 50 of the Key to North American Species of *Drosophila* of Sturtevant (1942), to which point an attempt to classify a specimen of *D. melanura* should lead one.

- 50a. Male genital region dark brown ..... *melanura*  
 Male genital region not dark brown ..... *melanica*

DISTRIBUTION.—This species has been collected only in a small wood on the campus of the University of Rochester (River Campus), Rochester, New York.

Type specimens of *D. melanura* are deposited in the American Museum of Natural History, New York, N. Y.

Comparison with *D. melanica*

*Drosophila melanura* has been compared with individuals taken from *D. melanica* strains kept in this laboratory. These strains have been classified as to subspecies (*melanica* or *paramelanica*) by Prof. A. H. Sturtevant. The above description of *D. melanura*, as well as the notes which follow, is based largely on individuals of the single existing strain of this species, derived as indicated in the first paragraph.

The impression has been gotten that *D. melanura* is a larger form than *D. melanica*. This has been gotten not so much from wild individuals as from flies raised in the laboratory (the size measurements given in the above description were taken from "average" laboratory individuals). The difference in size may be partly due to the fact that the new species has not bred as vigorously in the laboratory as has *D. melanica* and has usually had the advantage of relatively uncrowded culture bottles.

*D. melanura* has also seemed to have a lighter body color than *D. melanica*. This difference is especially noticeable on the dorsal surface of the thorax, which may be described as medium brown in the new form, dark brown or very dark brown in *D. melanica*. Accompanying this difference is a greater prominence of the mesonotal stripes in *melanura* than in *D. melanica*. It is the impression of the author that the *D. melanica* subspecies tend to differ from each other in that *melanica* is somewhat darker than *paramelanica*. The thorax color difference between *melanura* and *D. melanica melanica* has been quite striking. Since a body color difference was not appreciated at the time the collections of *melanura* and *D. melanica* (probably *paramelanica*) were being made, the separation of wild females on the basis of color was not attempted. It remains to be seen how reliable a criterion this is for the identification of wild individuals in general.

The abdominal banding pattern of *D. melanura* males was found to be different from that of the *D. melanica* males examined. Whereas in *melanura* males the band on the 6th segment (as well as the others) was always found to be complete laterally, this was never seen to be the case in *D. melanica* males. In a *D. melanica* strain (*paramelanica*) from South Amherst, Massachusetts, the males' abdominal bands were all found to become indistinct near the lateral margins of the tergites. In a *D. melanica* strain (*melanica*) from Walnut Creek, Texas, while the bands on the 2nd through 5th abdominal segments generally extended all the way to the edges to the tergites, the band on the 6th segment was interrupted laterally.

Mention has already been made of the darkly pigmented genital region of males of the new species. This seems to be the best character whereby it may be recognized as different from *D. melanica*. In *D. melanura* males the genital arch, anal plates, and claspers become dark brown a few days after emergence. The plates of the penis apparatus also become dark. The result is that the genital region stands out conspicuously against the light ventral abdominal wall. In *D. melanica* the male genital region seems relatively inconspicuous.

In *D. melanura* and in *D. melanica* the penis apparatus apparently consists of two rather broad lateral plates as well as the



structure probably homologous to the chitinous rod called the penis by some authors (for example, Nonidez, 1920, in *D. melanogaster*). The appearance of the lateral plates was found to

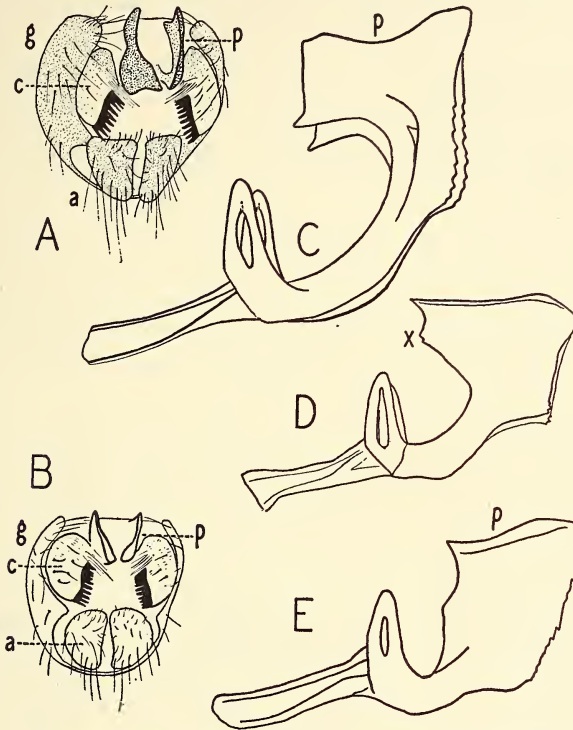


FIG. 1. A. Male genital region of *D. melanura*. B. Male genital region of *D. melanica paramelanica* (South Amherst, Mass.). The labels indicate: the anal plates (a), claspers (c), genital arch (g), and penis apparatus (p). These drawings were made from dead specimens, and the penis apparatus is shown farther forward than its usual position in living, etherized individuals. C. Penis apparatus of *D. melanura*. D. Penis apparatus of *D. melanica melanica* (Walnut Creek, Texas). E. Penis apparatus of *D. melanica paramelanica* (South Amherst). C, D, and E are side view drawings made on a somewhat larger scale than A and B. The edges labelled with a "p" in C and E correspond to the edges so labelled in A and B respectively. The point labelled with an "x" in D was found to vary somewhat in prominence.

differ between *melanura* and *D. melanica*. In *melanura* they were deeply incised at the anterior edge (Figure 1, C), whereas

in *D. melanica* they were not so much or scarcely at all so incised (Fig. 1, D & E). The structure of the plates in *D. melanica melanica* strains examined (Walnut Creek, Texas; Coffeerville, Kansas; Taneycomo, Missouri) seemed intermediate (Fig. 1, D) between that of *D. melanura* (Fig. 1, C) and that of *D. melanica paramelanica* strains (Madison, Wisconsin; South Amherst, Massachusetts) (Fig. 1, E). In *D. melanura* the impression was gotten that the penis apparatus is somewhat larger and more conspicuous relative to its surroundings than in *D. melanica* (Fig. 1, A & B).

The anterior spiracle horns of the puparium were found to be relatively shorter in *D. melanura* than in *D. melanica*. The horn index (length of puparium/length of horn) was determined to be about 12 in *melanura*, whereas *melanica* estimates were 9 for the South Amherst strain (*paramelanica*) and 7 for the one from Walnut Creek (*melanica*).

The chromosomes of *D. melanura* were investigated by means of acetic orcein smear preparations of larval ganglia and of ovaries and testes taken from pupæ and adults (using the 70 per cent acetic acid stain of LaCour, 1941). Examples of chromosome groups are given in Figure 2, A, B, and C. It may be seen that the smallest chromosome is not dot-shaped, as was reported in *D. melanica* by Metz (1916), but, rather, a small V. An investigation of *D. melanica* chromosomes, both *paramelanica* (South Amherst and Madison) and *melanica* (Walnut Creek), has confirmed Metz' report of dot-like chromosomes in this species (Figure 2, D, E, and F). Of interest here is the statement of Griffen (1942) that the *melanica* group species *D. nigromelanica* Patterson and Wheeler (1942) has rod-shaped microchromosomes rather than dots. The salivary gland chromosomes of *D. melanura* have not been studied.

As may be seen from the first paragraph of this paper *D. melanura* males were gotten in the summer, 1941, collections at Rochester in a much smaller number than were *D. melanica* males. Moreover, *D. melanura* was only collected past the middle of summer, late in August, while *D. melanica* occurred in the traps by early June. An ecological difference between the two species is suggested. *D. nigromelanica* was collected also

and had an occurrence in the traps similar to that of *D. melanura*; from July 26 to August 25 there were gotten 26 individuals of this species, 11 of which were males. A record of the collections of these *melanica* group species is given in Table 1.

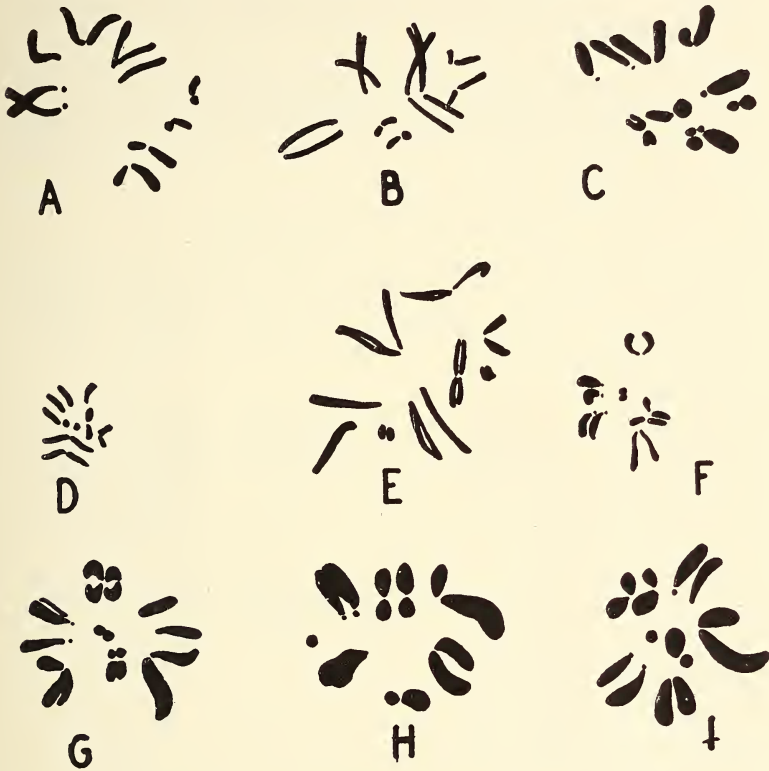


FIG. 2. A and B. *D. melanura* ovary metaphase figures. C. *D. melanura* testis metaphase. D and E. *D. melanica paramelanica* (South Amherst) ovary metaphases. In E some of the chromosomes, including the dot-like ones, are obviously split. F. *D. melanica melanica* (Walnut Creek) testis metaphase. The dots are close together. G, H, and I. Metaphase figures found in the testes of hybrids derived from *melanica* (Walnut Creek) females mated to *melanura* males.

*D. melanura* has been kept with some difficulty on the *Drosophila* culture media in use at this laboratory. The impression has been gotten that *D. melanica* has not been so difficult to main-

tain. In December, 1941, our corn meal-molasses-agar medium was changed in that agar was omitted from it and rolled oats were added (formula of Dr. R. H. MacKnight). The result has been a somewhat softer, wetter medium. From soon after the

TABLE 1. Week-by-week record of *melanica* group species collections at Rochester, New York, during the summer of 1941. The number of *D. melanura* females gotten is not recorded; these were most probably all classified as *D. melanica* females. Since the circumstances of collection (number of traps, number of collections, etc.) varied from week to week, the variation in absolute numbers should not be taken to reflect very well the changing state of the wild population.

		Collections for the week beginning: .				
		June 1	June 8	June 15	June 22	June 29
<i>melanica</i>	♂ ♂	...	...	5	18	40
	♀ ♀	2	3	3	26	41
<i>nigromelanica</i>						
<i>melanura</i>						
		July 6	July 13	July 20	July 27	Aug. 3
<i>melanica</i>	♂ ♂	171	47	74	134	115
	♀ ♀	111	19	38	125	93
<i>nigromelanica</i>	♂	.....	.....	.....	.....	1
	♀ ♀	.....	.....	1	1	6
<i>melanura</i>						
		Aug. 10	Aug. 17	Aug. 24	Total	Total
<i>melanica</i>	♂ ♂	46	57	18	725	
	♀ ♀	26	35	16	538	1263
<i>nigromelanica</i>	♂ ♂	7	3	.....	11	
	♀ ♀	5	.....	2	15	26
<i>melanura</i>	♂ ♂	.....	7	3	10	10

change was made until about the middle of May, 1942, the *D. melanura* strain refused to breed at all. Following this period there has been a gradual recovery of ease of culture.

#### Hybrids with *D. melanica*

A few attempts were made to cross *D. melanica* females with *D. melanura* males, several individuals of a kind being used in each mating. Progeny have been gotten both from crosses of *melanica* (Walnut Creek) females by *melanura* males and from *paramelanica* (Madison) females by *melanura* males (Table 2).



A few matings were also made between *D. nigromelanica* females and *melanura* males, using a Harden County, Texas, strain furnished by Prof. J. T. Patterson, but no progeny were gotten (Table 2).

In general the interspecific cross progeny have been not very different from the maternal species. The penis apparatus of the

TABLE 2. Interspecific crosses involving *D. melanura*. The flies were put into fresh culture bottles on the dates listed under each mating. The numbers of progeny are placed opposite the dates appropriate to the bottles in which they occurred.

Cross	Progeny		
	♀ ♀	♂ ♂	Totals
<i>D. melanica melanica</i> ♀ ♀ × <i>D. melanura</i> ♂ ♂			
Walnut Creek ♀ ♀ × Rochester ♂ ♂ (7 of each)			
8- 7-42			
8-10-42			
8-15-42			
Walnut Creek ♀ ♀ × Rochester ♂ ♂ (22 of each)			
8- 8-42			
8-11-42	15	18	
8-15-42	7	7	
	—	—	
	22	25	47
Walnut Creek ♀ ♀ × Rochester ♂ ♂ (15 of each)			
8-10-42			
8-15-42	20	15	
8-19-42	40	35	
8-24-42	7	6	
8-31-42	46	31	
9- 8-42	24	24	
	—	—	
	137	111	248
<i>D. melanica paramelanica</i> ♀ ♀ × <i>D. melanura</i> ♂ ♂			
Madison ♀ ♀ × Rochester ♂ ♂ (5 of each)			
8- 8-42			
8-11-42			
8-15-42			
Madison ♀ ♀ × Rochester ♂ ♂ (7 of each)			
8-10-42			
8-15-42			
8-19-42			

TABLE 2—(Continued)

Cross	Progeny		
	♀ ♀	♂ ♂	Totals
<i>D. melanica paramelanica</i> ♀ ♀ × <i>D. melanura</i> ♂ ♂ (cont.)			
Madison ♀ ♀ × Rochester ♂ ♂ (15 of each)			
8- 7-42			
8-10-42			
8-15-42	6	6	
8-24-42	18	16	
8-31-42	5	4	
9- 8-42	—	1	
	29	27	56
<i>D. nigromelanica</i> ♀ ♀ × <i>D. melanura</i> ♂ ♂			
Harden Co. ♀ ♀ × Rochester ♂ ♂ (8 of each)			
9- 8-42			
9-12-42			
Harden Co. ♀ ♀ × Rochester ♂ ♂ (4 of each)			
9-1-42			
9-4-42			
9-8-42			
Harden Co. ♀ ♀ × Rochester ♂ ♂ (13 of each)			
9- 4-42			
9- 8-42			
9-10-42			

hybrid males, for example, has been rather similar to that of males of the form to which the mother belonged. Both sexes have seemed quite viable, and the sex ratio has been about 1 to 1 (Table 2).

Metaphase plates found in the testes of hybrid males derived from both the kinds of crosses mentioned above contained one dot-like chromosome and one small V (Fig. 2, G, H, and I). This evidence may be offered as one form of proof of the hybrid nature of these offspring. The salivary gland chromosomes of several larvæ were looked at, and although a very careful study of these chromosomes was not made, it did seem likely that they were heterozygous for a number of chromosomal rearrangements, probably inversions.

TABLE 3. Backcrosses of hybrid females to *D. melanura* and to *D. melanica*.

Cross	Progeny		
	♀ ♀	♂ ♂	Totals
( <i>melanica</i> ♀ ♀ × <i>melanura</i> ) ♀ ♀ × <i>D. melanura</i> ♂ ♂			
(W. C. ♀ ♀ × Roch.) ♀ ♀ × Rochester ♂ ♂ (13 of each)			
8-31-42			
9- 3-42			
9- 8-42			
(W. C. ♀ ♀ × Roch.) ♀ ♀ × Rochester ♂ ♂ (7 of each)			
9-1-42			
9-4-42			
9-8-42			
( <i>paramelanica</i> ♀ ♀ × <i>melanura</i> ) ♀ ♀ × <i>D. melanura</i> ♂ ♂			
(Mad. ♀ ♀ × Roch.) ♀ ♀ × Rochester ♂ ♂ (2 of each)			
9- 4-42			
9- 8-42			
9-10-42			
( <i>melanica</i> ♀ ♀ × <i>melanura</i> ) ♀ ♀ × <i>D. melanica melanica</i> ♂ ♂			
(W. C. ♀ ♀ × Roch.) ♀ ♀ × Walnut Creek ♂ ♂ (17 of each)			
9- 4-42			
9- 8-42			
9-10-42	45	30	
9-18-42	26	15	
9-25-42	31	20	
	102	65	167
( <i>paramelanica</i> ♀ ♀ × <i>melanura</i> ) ♀ ♀ × <i>paramelanica melanica</i> ♂ ♂			
(Mad. ♀ ♀ × Roch.) ♀ ♀ × Madison ♂ ♂ (9 of each)			
9-30-42			
10- 3-42			
10- 8-42			

No offspring have been gotten from hybrid males and females kept together. It seems likely that the males are sterile. Although hybrid testes were found to contain many sperms, no motility of these sperms in Ringers' solution was seen. Moreover, acetic orcein smears have shown these testes to contain a number of rather large, spindle-shaped, dully-staining bodies, but no regular sperm heads. It is probable that these elongate structures are the product of an abnormal spermiogenesis.

Attempts have been made to backcross hybrid females both to *D. melanura* and to *D. melanica* males, and offspring were gotten in the case of a group mating of hybrid females (Walnut Creek ♀♀ × Rochester ♂♂) to Walnut Creek males (*melanica*) (Table 3). A rather obvious excess of females over males may be seen in these progeny. Since no mutants were involved in the crosses that gave rise to them, little could be concluded about the genetic constitution of the back-cross individuals. Some of the males were dissected 10 or 11 days after emergence and their testes examined. Out of 20 such males 2 had testes containing small, pyknotic bodies of various shapes, but no normal sperm heads, while the others had normal appearing sperms. Several recently hatched males were dissected and their testes examined for chromosome groups. In one of the testes there were found rather clear figures showing the presence of a dot and small V together, and in this testis there were a number of quite normal appearing sperm heads.

#### SUMMARY

*Drosophila melanura*, a new species similar to *D. melanica* Sturt., is described here. Notes on comparison of the two forms are presented. These species differ cytologically in the appearance of the smallest chromosome in the metaphase plate, *D. melanura* having a small V where *D. melanica* has a dot. Hybrids have been obtained from crosses between *D. melanura* females and *D. melanica* males, and the female hybrids have proved to be fertile.

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## LITERATURE CITED

- GRIFFEN, A. B. 1942. Relationships in the Melanica Species Group. Univ. of Texas Publ., 4228: 68-73.
- LACOUR, L. 1941. Acetic-orcein: A New Stain-fixative for Chromosomes. Stain Techn., 16: 169-174.
- METZ, C. W. 1916. Chromosome Studies on the Diptera. III. Additional Types of Chromosome Groups in the Drosophilidæ. Amer. Nat., 50: 587-599.
- NONIDÉZ, J. F. 1920. The Internal Phenomena of Reproduction in Drosophila. Biol. Bull., 39: 207-230.
- PATTERSON, J. T. 1942. Interspecific Hybridization in the Genus Drosophila. Univ. of Texas Publ., 4228: 7-15.
- and M. R. WHEELER. 1942. Description of New Species of the Subgenera Hirtodrosophila and Drosophila. Univ. of Texas Publ., 4213: 67-109.
- STURTEVANT, A. H. 1916. Notes on North American Drosophilidæ with Descriptions of Twenty-three New Species. Ann. Ent. Soc. Amer., 9: 323-343.
- . 1942. The Classification of the Genus Drosophila, with Descriptions of Nine New Species. Univ. of Texas Publ., 4213: 5-51.